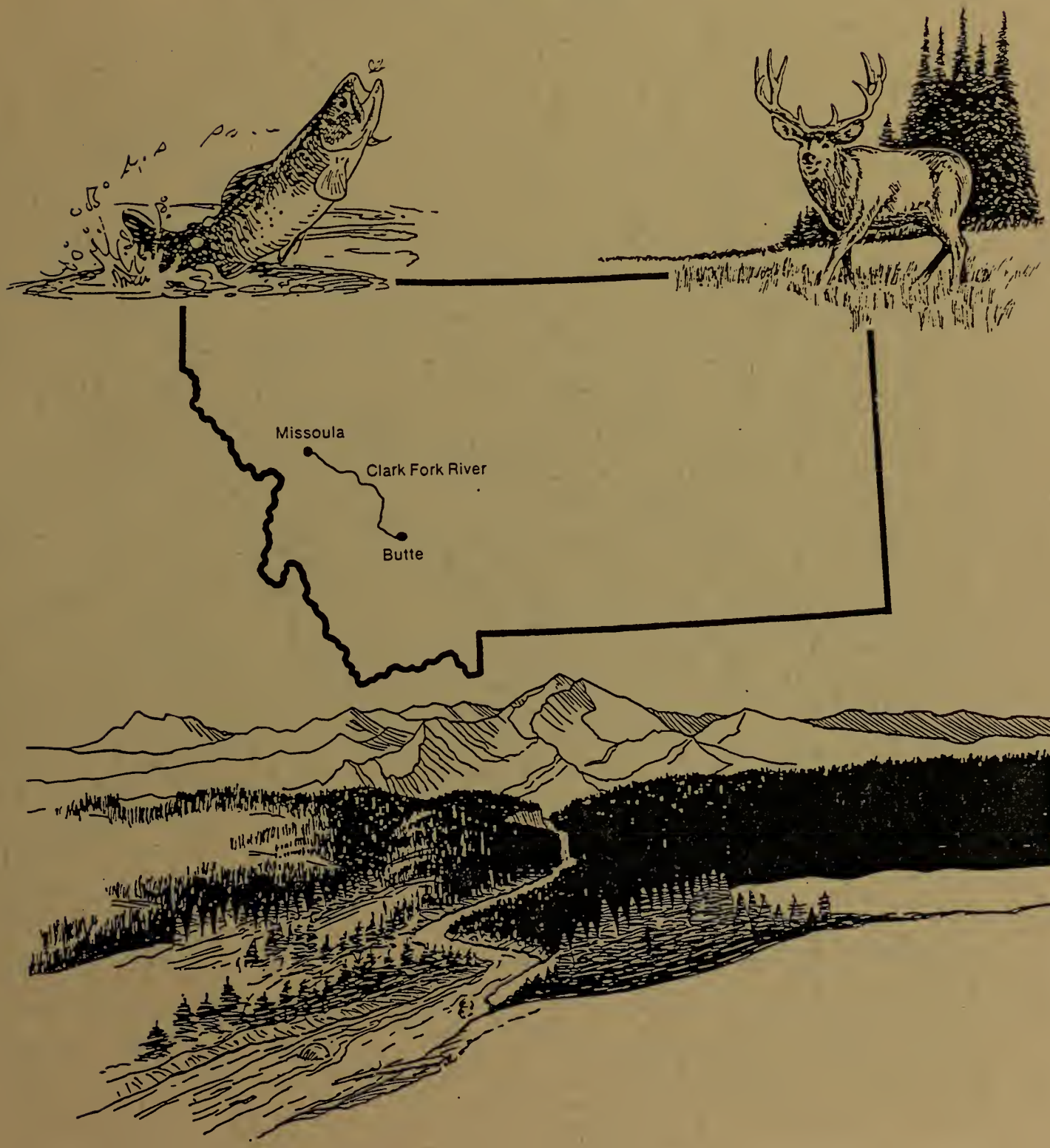
STATE OF MONTANA
NATURAL RESOURCE DAMAGE PROGRAM

MODIFICATIONS TO ASSESSMENT PLAN
CLARK FORK RIVER BASIN NPL SITES

JANUARY 1995



MODIFICATIONS TO ASSESSMENT PLAN

CLARK FORK BASIN NPL SITES

MONTANA

STATE OF MONTANA

NATURAL RESOURCE DAMAGE LITIGATION PROGRAM

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The DOI regulations provide that a natural resource damage assessment plan may be modified at any stage of the assessment as new information becomes available. 43 C.F.R. § 11.32(e)(1). If a modification is significant, the modification should be made available for public review before tasks called for by the modification are begun. If the modification is not significant, then the modifications should still be made available for public review, but implementation of the modification need not be delayed pending public review. 43 C.F.R. § 11.32(e)(2)(i),(ii).

As the State implemented its Assessment Plan, Parts I, II and III, additional information and analyses became available. As a result, the State modified Parts I, II and III of its Assessment Plan. The modifications did not change the nature or scope of the injury determination, injury quantification, or damage determination phases. Rather, they were most often minor alterations of some of the tasks identified in the Assessment Plan. Additionally, some of the modifications were the result of the State's review of comments made by ARCO and others to the Assessment Plan. Therefore, the State determined that these changes to the Assessment Plan were not significant. As required, each modification and the reason for each modification are hereby made available for review.

The State also reviewed the Assessment Plan, Parts I and II, following completion of the injury determination phase. 43 C.F.R. § 11.32(f). Methodologies for quantifying injury and determining damages were found to be consistent with the results of the injury determination phase and the use of these methodologies met the requirement of reasonable cost.

Specific deviations from sampling plans and the Quality Assurance Project Plan (QAPP) are discussed in the accompanying Quality Assurance/Quality Control (QA/QC) Report.

Surface Water

MODIFICATION: Part I, Section 7.3.4, page 29. Surface water injury was not evaluated on the basis of drinking water standards or hazardous substance concentrations in bed sediments.

REASON: The State focused its injury determination on ambient water quality criteria for the protection of aquatic life because injury to trout populations was the most relevant injury with respect to aquatic resources. Injury determination based on hazardous substance

concentrations in bed sediments could not be readily evaluated and was determined to be unnecessary.

MODIFICATION: Part II, Section 2.5.2, page 22. IFIM sites were not sampled six times during summer low flows. Rather, summer low-flow sampling consisted of one sample collected from each of four reference IFIM sites (Beaverhead River, Ruby River below Ruby Reservoir, Big Hole River at Kalsta Ranch, and Bison Creek).

REASON: Low flow sampling was curtailed because low flows occurred earlier in the year than anticipated. Therefore, some of the "high flow" spring samples actually represented conditions more characteristic of low flows. Thus, extensive low flow sampling was deemed unnecessary to evaluate differences in hazardous substance concentrations between the Clark Fork River and reference sites.

MODIFICATION: Part II, Section 2.5.2, page 23. Validation sampling was to include sampling of multiple cross-sections at one randomly selected site each sampling trip. Instead, a duplicate composite of the original cross-section was collected each trip.

REASON: The duplicate composite was deemed sufficient to evaluate variability associated with the sampling method.

MODIFICATION: Part II, Section 2.5.2, page 24. Silver Bow Creek headwater streams were not sampled during summer low flows. No low flow samples were collected.

REASON: As noted above, additional low flow sampling was deemed unnecessary because of the early onset of low flow conditions.

MODIFICATION: Part II, Section 2.5.2, page 24. Validation sampling of Silver Bow Creek headwater streams may have included the collection of duplicate grab samples at one sampling location each sampling run. Instead, one duplicate grab sample was collected on the last (third) sampling run.

REASON: Duplicate grab samples collected in the completion of other tasks provided information to assess variability associated with the grab-sampling method.

MODIFICATION: Part II, Section 2.5.2, page 24. Four day composite samples were not collected.

REASON: Flow conditions and field observations of water quality indicated that the likelihood of fulfilling study objectives would be low. Consequently, this task was not completed.

MODIFICATION: Part II, Section 2.5.3, page 24. "Suspended, recoverable" metals concentrations were not determined.

REASON: This determination was considered to be unnecessary for the surface water injury assessment because injury determination is based on total recoverable concentrations of hazardous substances in surface water, which includes both the "suspended, recoverable" component as well as the dissolved component.

Fisheries

MODIFICATION: Part I, Section 7.4, page 31. Benthic macroinvertebrates were evaluated for injury, but were not identified in the Plan as a biological resource that would be evaluated for injury.

REASON: Although the State initially considered benthic macroinvertebrates primarily in the context of a pathway resource to other injured resources (i.e., trout), the State decided that a determination of injury to benthic macroinvertebrates could be readily made with available data. The State proceeded to determine and quantify injury to benthic macroinvertebrates in Silver Bow Creek.

Toxicology

MODIFICATION: Part I, Section 7.4.4.1, page 35. Diets were analyzed and reported on a dry weight basis instead of a wet weight basis.

REASON: Dry weight provides a better basis for comparing hazardous substance concentrations in different diets than wet weight.

MODIFICATION: Part I, Section 7.4.4.1, page 37. Fish were not sampled from the

Clark Fork River downstream of Gold Creek for physiological impairment studies.

REASON: Fish collected from the Clark Fork River downstream of Warm Springs Ponds and at Turah provided a sufficient sample size for study objectives.

MODIFICATION: Part I, Section 7.4.4.1, page 37. Five fish were not collected specifically for whole body metals analysis, and additional fish were not collected for quality control analyses.

REASON: Whole body metals analysis were conducted on fish collected for analysis of other tissues, which provided a larger sample size for whole body metals analysis. Given the number of fish collected (10 each from the Big Hole River and the Clark Fork at Warm Springs, and 9 each from Rock Creek and the Clark Fork at Turah), additional fish for quality control were not needed.

MODIFICATION: Part I, Section 7.4.4.1, page 37. Water samples were not collected from control and test sites for metals and anions measurements.

REASON: The objective of this study was to evaluate exposure of fish to hazardous substances by determining their bioaccumulation in various fish tissues. Point in time water samples may or may not correlate to tissue concentrations of hazardous substances, and may not necessarily represent concentrations typically found in the Clark Fork River and other streams. Consequently, water samples were not collected.

MODIFICATION: Part I, Section 7.4.4.1, page 38. Pulse exposure tests were conducted over eight hours instead of two hours. In addition, pulse concentrations were based on dissolved concentrations documented during a fish kill that occurred in the Clark Fork, rather than on the highest concentrations measured during actual pulse events.

REASON: The lengthened exposure time (eight hours) provided more information for determining effect concentrations (i.e. LC50s, lowest observed effect concentrations (LOEC), and no observed effect concentrations (NOEC)) than the shorter exposure time (two hours) would have provided. It was concluded that water quality conditions during a documented fish kill provided a better basis for test concentrations than a pulse event of undocumented biological

significance.

MODIFICATION: Part I, Section 7.4.4.1, page 38. The Big Hole River was not used as a source of brown trout for pulse event tests in Task 2.

REASON: Clark Fork brown trout, hatchery brown trout, and hatchery rainbow trout provided an adequate number of sources to evaluate the relative sensitivity of trout to pulse events.

MODIFICATION: Part I, Section 7.4.4.1, page 39. Task 2 tested 0X and 1X metals concentrations in waters of pH 5.0, 6.0, 7.0 and 8.0. Control water was 0X metals concentrations with a pH of 8.0.

REASON: The added component (0X metals concentrations) provided additional information on the effects of pH on avoidance behavior.

MODIFICATION: Part I, Section 7.4.4.1, page 39. Task 3 did not test a simulated medium hardness tributary water. Test waters included a 0X metals concentration in addition to the 1X metals concentration. Fish were acclimated for four days to the control water instead of two weeks.

REASON: Tests of the simulated soft water and hard water tributaries provided adequate information on the effects of hardness on avoidance behavior. The 0X test water was added to better discern the effects of hardness and metals on avoidance behavior. The four day acclimation period was appropriate for fish acclimating to a reference water that contained no metals and for which the relevant variable was hardness.

MODIFICATION: Part I, Section 7.4.4.1, page 39. A task was added to assess the effects of acclimation (specifically, acclimation to a Clark Fork water containing metals) on avoidance behavior.

REASON: None of the described tasks were designed to evaluate the effects of metals acclimation (1X concentration) on avoidance behavior. Metals acclimation is a potentially important factor in explaining avoidance behavior, particularly in the Clark Fork where fish are

continuously exposed to elevated metals concentrations.

MODIFICATION: Part I, Section 7.4.4.1, page 39. Still frame pictures were not used to evaluate behavioral responses. Instead, behavioral responses were evaluated by analyzing continuous videotapes.

REASON: It was decided that continuous monitoring of the 20 minute exposure period provided a more complete determination of behavioral responses than analyzing a set number of still frame pictures.

MODIFICATION: Part I, Section 7.4.4.1, page 40. The Big Hole River was not used as a source of trout for the acclimation and adaptation study.

REASON: Clark Fork brown trout, hatchery brown trout, and hatchery rainbow trout provided an adequate number of sources to evaluate the effects of adaptation and acclimation on toxicity.

MODIFICATION: Part III, Section 6.0, page 5. Trout gut contents were not collected for analysis of hazardous substance concentrations.

REASON: Juvenile brown trout, the subject of this task, were not located during the field collection effort.

Population/Habitat

MODIFICATION: Part I, Section 7.4.4.2, page 41. All fisheries population sites were sampled in the summer of 1991. One additional fisheries populations site and its control were sampled in 1992.

REASON: As planned, 18 reaches of the Clark River/Silver Bow Creek were sampled during the summer of 1991. Subsequently, an additional site below the Warm Springs Ponds and a matched control site on the Beaverhead River were sampled during the summer of 1992 in order to analyze conditions just downstream of the Warm Springs Ponds.

MODIFICATION: Part III, Section 3.2, page 4. Two trout population estimation

techniques, snorkeling and mark-recapture, were not compared.

REASON: Electroshocking necessary to obtain a mark-recapture estimate was considered too stressful on trout, given the low stream flows and high water temperatures that were common throughout western Montana in the summer of 1994.

Sediments

MODIFICATION: Part I, Sections 7.5.2 and 7.5.3, page 43. Bed sediments of Silver Bow Creek, the Warm Springs Ponds, and the Clark Fork River were not assessed for injury.

REASON: The State elected to exclude Warm Springs Ponds from the assessment area for aquatic resources because the Ponds are a hazardous waste treatment system. The Ponds were assessed as a source of hazardous substances to injured groundwater and aquatic resources, using existing data. In addition, the State chose to focus its assessment of Silver Bow Creek and the Clark Fork River bed sediments as a pathway resource to other aquatic resources. Bed sediment sampling also provided much information concerning hazardous substance source identification.

MODIFICATION: Part I, Section 7.5, pages 43 - 45. Sampling and analysis of sediments in Silver Bow Creek for pentachlorophenol (PCP) was not discussed in the Assessment Plan. However, Silver Bow Creek sediments were sampled and analyzed for PCP.

REASON: Money provided to the State by ARCO under certain administrative orders of consent were allocated to various studies. One such study, the sampling and analysis of Silver Bow Creek sediments for PCP, was undertaken to evaluate the potential for injury to aquatic resources due to the migration of PCP from the Montana Pole Treating Plant site.

Groundwater

MODIFICATION: Part I, Section 7.6.2, page 46. Groundwater at Rocker was also evaluated for injury.

REASON: Assessment of groundwater at Rocker was not specifically mentioned in the description of groundwater resources to be assessed. The Plan more generally referred to groundwater resources in the Butte area, which could also include the Rocker groundwater. The

State, upon further consideration, decided to proceed with an evaluation of Rocker groundwater.

MODIFICATION: Part I, Section 7.6.4, page 47; Part II, Section 2.6.1, page 25. Surface water samples in the Thompson Park area were not collected.

REASON: Upon further evaluation, it was concluded that groundwater samples collected from the Butte bedrock aquifer better characterized baseline groundwater quality than surface water samples in the Thompson Park area.

MODIFICATION: Part II, Section 2.6.1, page 25. Three alluvial wells were drilled and sampled in Butte/Area One in order to help establish baseline conditions.

REASON: Review of existing data indicated that additional data on baseline conditions in the alluvial aquifer would be useful.

MODIFICATION: Part II, Section 2.6.1, page 25. Groundwater samples were not collected from bedrock wells A and C.

REASON: Samples collected from wells B, D1, D2 and E provided sufficient data for characterizing baseline groundwater quality. In addition, wells A and C were not available for sampling because of concerns raised by ARCO and EPA about the low production of these wells.

Air

MODIFICATION: Part II, Section 2.3.2, page 5. Air resources and impacts associated with releases to air were not assessed near Butte.

REASON: There were not sufficient available data to assess releases to air, and associated impacts, in the Butte area.

MODIFICATION: Part II, Section 2.3.3, page 6. Air resources of the Clark Fork Basin were not evaluated for injury.

REASON: The State believed that it was more important to evaluate air as a pathway resource rather than as an injured resource.

Soils and Vegetation

MODIFICATION: Part II, Sections 2.4.2.1 and 2.4.2.2, pages 9-10. The Warm Springs Ponds and upland areas near Butte (primarily the Yankee Doodle Tailings) were not evaluated for injury to soils and vegetation.

REASON: The State excluded Warm Springs Ponds from the area assessed for injury to soils and vegetation. Samples collected from the Yankee Doodle Tailings did not contain concentrations of hazardous substances sufficiently elevated to warrant further investigation.

MODIFICATION: Part II, Section 2.4.2.1 and 2.4.2.2, page 9-10. The assessment of soils and vegetation resources on the Clark Fork River did not extend from Warm Springs Ponds to Garrison. Rather the assessment extended from Warm Springs Ponds to Deer Lodge.

REASON: The State decided to focus its injury assessment on areas of the floodplain that were grossly impacted (largely or virtually devoid of vegetation). Most of these areas occur between Warm Springs Ponds and Deer Lodge, and generally do not extend further downstream than Deer Lodge.

MODIFICATION: Part II, Section 2.4.3.1, page 11. Injury to soils was not quantified solely by mapping the areal extent of injured soils.

REASON: Injury was quantified by using existing information, including maps, aerial photographs, ground truthing, and measurements of soil phytotoxicity.

MODIFICATION: Part II, Section 2.4.5.1, page 15. The number of sample intersection grid points in the uplands impacted areas was increased from approximately 24 to 40. Additionally, 20 paired control sites were sampled rather than approximately 12. The planned additional sampling regarding erosional and depositional areas, however, was not performed.

REASON: Sample sizes were increased to provide additional statistical power and areal coverage. This was also more efficient than specifically sampling erosional and depositional zones.

MODIFICATION: Part II, Section 2.4.5.1, p. 15. Locating transects and sampling

points in the field was not accomplished using Global Positioning System (GPS) instruments during the 1992 sampling.

REASON: The GPS was unable to locate the requisite number of satellites to establish a point with acceptable precision, presumably because of the rugged terrain and signal interference, along with the limited number of satellites available in 1992. Accordingly, sites were located using U.S. Geological Survey maps, compasses, and landscape features in the 1992 sampling.

MODIFICATION: Part II, Section 2.4.5.1, page 16. Only three of four reaches delineated on Silver Bow Creek were sampled to quantify riparian injury.

REASON: The Durant Canyon reach of Silver Bow Creek was not sampled due to time constraints and the relatively few tailings deposits within this reach.

MODIFICATION: Part II, Section 2.4.5.1, page 16. A belt transect, as originally described, was not used to locate sampling transects in riparian areas. Instead, six sampling transects were located randomly within each of the three reaches that were sampled.

REASON: Belt transects would have unnecessarily restricted sampling to a predefined portion of the floodplain. Given the variability in the spatial distribution of slickens areas, the method used to locate sampling transects more specifically targeted those slickens areas hypothesized to be injured.

MODIFICATION: Part II, Section 2.4.5.1, page 16. Soluble arsenic and exchangeable metals concentrations were measured, but were not evaluated in the assessment of injury to vegetation.

REASON: A review of the literature indicated that total metals concentrations were likely to relate better to phytotoxic effects than exchangeable metals. Therefore, the State decided to focus on total metals.

MODIFICATION: Part II, Section 2.4.5.2, pages 18-19. Initial evaluation (i.e. screening) phytotoxicity tests included alfalfa, in addition to lettuce and wheat. Extended

phytotoxicity tests were restricted to hybrid poplar cuttings. The dilution series for extended tests (upland and riparian sites) was reduced from four to the following three:

(a) 100% site soil; 0% reference soil;

(b) 50% site soil; 50% reference soil;

(c) 0% site soil; 100% reference soil.

REASON: Alfalfa is a commonly used test species of known phytotoxicity endpoints that could readily be incorporated into the study design. Insufficient soils volumes were available, following laboratory sieving, to conduct the number of species-tests and dilution series identified in the Assessment Plan. The number of tests and dilutions was reduced to conform to available sample volumes. Finally, Douglas fir seedlings were tested early on in the study, but produced unsatisfactory results.

Wildlife

MODIFICATION: Part II, Section 2.4.3.3, page 13 and Section 2.4.5.3, page 20. Tissue levels of hazardous substances were not determined in birds that consume aquatic biota or their prey (specifically, great blue heron nestlings were not collected and residues of hazardous substances and physiological abnormalities were not determined).

REASON: Most (if not all) piscivorous birds found along the upper Clark Fork River are seasonal occupants, migrating during the fall as far south as Central America and as far west as the Pacific coast. The evaluation of residue would be ambiguous because of these confounding influences. Piscivorous birds residing along the Upper Clark Fork may feed principally from nearby lakes and streams, further adding to confounding factors.

MODIFICATION: Part II, Section 2.4.5.3, pages 19-20. Habitat evaluation procedures (HEP) evaluation in upland areas did not include blue grouse or mule deer. Wildlife Habitat Suitability Index models (HSI) and HEP were not used to evaluate the quality of riparian habitat for furbearers (i.e. mink). Instead, habitat comparisons were made between the Clark Fork and riparian control areas through the classification of surveyed river reaches into habitat type percentages.

REASON: The HEP evaluations conducted for upland areas (marten and elk) were

sufficient to determine injury to upland wildlife habitat. For riparian habitat and furbearers, the direct visual observation of habitat structural features and animal sign information obviated the need for HEP models.

MODIFICATION: Part II, Section 2.4.5.3, page 20. The relative abundance of birds was quantified by two on-the-ground surveys, rather than by canoe surveys and existing data (i.e., population densities, nest density, and fledgling success).

REASON: On-the-ground surveys obtained sufficient information for characterizing the relative abundance of birds in impact and control sites.

Recreation Economics

MODIFICATION: Part II, Section 4.3.3.2, page 37: The number of follow-up surveys was increased from one to multiple waves.

REASON: Multiple follow-up surveys were employed to minimize the potential for recall bias in the reporting of trip data.

MODIFICATION: Part II, Section 4.3.3.3, pages 37-38. Contingent valuation method (CVM) questions were included in the follow-up survey of recreational anglers. Rather than use willingness-to-pay (WTP) type questions as originally discussed, the survey used contingent participation questions.

REASON: Contingent participation questions allow investigation into the correlation between observed, modeled and stated intentions concerning participation and site choice. Also, willingness-to-pay questions for changes in fishing in Montana are available in the existing literature. Thus, contingent participation questions were judged to be more useful to the damage determination than WTP questions for this sample group.

MODIFICATION: Part II, Section 4.3.3(a), pages 40-41. Non-fishing recreation was specifically assessed through a postcard survey at each of the sites included in the fishing survey, rather than by in-field observation. Postcards were left at cars, bicycles, and with individuals intercepted during the in-field fishing survey. These postcards requested information on the

number of individuals in the party, the number engaged in fishing and non-fishing recreation, and the types of non-fishing recreation. License plate logs were retained at each site and used to determine response rates for each site and to adjust for any differences in response rates across sites. Other efforts that collected new non-fishing recreation data included a boating survey; a mail survey of anglers; and aerial photography of the Bitterroot River corridor.

REASON: The postcard survey allowed for a cost-effective and more rigid sampling procedure, allowed for more sites to be included, and better identified the types of non-fishing recreation activities occurring on surveyed reaches.

MODIFICATION: Part II, Section 4.4.3(a), page 41. The in-field survey of non-fishing recreators, and the subsequent follow-up survey, was dropped from the assessment.

REASON: The postcard survey of non-fishing recreators along river corridors, combined with existing literature on non-fishing recreation and values, eliminated the need for this task. Given that the necessary data for damage determination were available elsewhere, the task was not performed.

MODIFICATION: Part II, Section 4.4.3(b), page 41. The specific assessment of damages related to consumptive and non-consumptive wildlife recreation away from rivers was not undertaken.

REASON: This analysis could not be cost effectively implemented, and was not particularly necessary given that combined use and non-use values for wildlife impacts are included in the CVM analysis.

Contingent Valuation Economics

MODIFICATION: Part II, Section 4.5.3, page 43. Focus groups were not used in pretesting the CVM survey instruments.

REASON: Pretesting relied on verbal protocols. Verbal protocols were a more cost-effective method of pretesting, and obtained the same information about instrument survey design as focus groups.

Market Price Analysis

MODIFICATION: Part II, Section 4.6, pages 44-46. A market price analysis was not undertaken for any of the injured natural resources.

REASON: Market price analyses for the injured natural resources other than ground and surface water, were considered unnecessary because damages were determined to be more fully measured by other methodologies. In addition, it was determined that within the State of Montana there is virtually no market for surface or ground water. The very limited market that may exist may not meet requirements of being a competitive market, and the prices are often for short-term use, limited uses, or are bundled with other resources such that these prices would have limited reliability for the intended assessment. In cases such as this market price methodologies normally should not be used and other valuation methodologies should be considered. See 43 C.F. R. § 11.83(c)(2) and (3). Hence, a study analyzing such other valuation methodologies, including alternative market based approaches and the factor price method, was undertaken to determine the value of groundwater use. See *Literature Review and Estimation of Municipal and Agricultural Values of Groundwater Use in the Upper Clark Fork River Drainage,* by Dr. John Duffield, Bioeconomics, Inc., March 18, 1994. An existing report, also prepared by Dr. Duffield, which utilized the factor price method, was used to determine the agricultural value of surface water.

Restoration

MODIFICATION: Part II, Section 4.2.2, page 31. Screening for the restoration determination also included the views of the potentially responsible party (PRP).

REASON: In addition to input from state and federal personnel and experts, views of the PRP were felt to be valuable in identifying the range of remediation actions that may be undertaken at each operable unit. These views were considered by the State.

MODIFICATION: Part II, Section 4.2.2, page 32. The State believes that CERCLA establishes a preference for alternatives that actually restore injured resources, thus except in the case of Butte Hill groundwater, where restoration was deemed impossible, alternatives for replacing or acquiring like resources and resource services were not included in the range of

restoration alternatives.

REASON: The State believes that CERCLA establishes a preference for alternatives that actually restore injured resources. Additionally, the State, as trustee, has discretion in identifying the range of restoration alternatives that will be evaluated. In all cases except one, the State chose to display restoration alternatives that directly addressed injured resources.

Quality Assurance Project Plan (QAPP)

MODIFICATION: Part I, Appendix A, page A-7, Table A-2. The QAPP provided that expanded control limit windows for data quality objectives for soil matrices would be used. The existing control limit windows approved by U.S. EPA for the RI/FS process were used.

REASON: ARCO and others commented regarding the analytical windows. The State considered the comments and determined that the existing analytical windows,approved by EPA, were appropriate for the NRDA.